

CLAIMS

1. An image encoding method for encoding image data formed by a plurality of frames, the image encoding method characterized by having

an image classifying step for classifying each frame of an encoding target into N sets ($N \geq 2$) of categories,

a predicted image producing step for producing a predicted image by selecting an image data from image data of a plurality of frames of an i -th ($1 \leq i \leq j$) category in a reference image memory which are encoded in past, for a current frame which is classified as a j -th category,

a difference encoding step for encoding a difference between the image data of the current frame and the predicted image,

a reference image specifying data encoding step for encoding a reference image specifying data for the j -th category, which specifies said selected image data,

a current category encoding step for encoding a category number of the current frame, and

an image storing step for storing the image data of the current frame into the reference image memory.

2. The image encoding method as described in claim 1, characterized in that

a frame number for specifying a frame belonging to a category is assigned for each of said categories, and

said reference image specifying data is formed by a category number to which the image data selected at said predicted image producing step belongs and a frame number of the category specified by that number.

3. The image encoding method as described in claim 1, characterized by further having

a difference decoding step for decoding an encoded

data produced by said difference encoding step, and
a decoded image producing step for producing a decoded image from a decoded data produced by said difference decoding step and said predicted image,

wherein said difference encoding step encodes said difference by an irreversible encoding, and

said image storing step stores a decoded image data of the current frame produced by said decoded image producing step.

4. The image encoding method as described in claim 1, characterized in that said reference image specifying data encoding step has

a tentative frame number setting step for setting a tentative frame number with respect to the image data of a frame belonging to the i-th category, among a plurality of image data stored in said reference image memory, and

a tentative frame number encoding step for encoding the tentative frame number which specifies the image data selected at said predicted image producing step, as the reference image specifying data.

5. The image encoding method as described in claim 4, characterized in that said tentative frame number setting step has

an encoding order recording step for recording an encoding order of a frame encoded in past as an encoding order number for each category, and

a tentative frame number determining step for determining the tentative frame number of the frame encoded in past, from the encoding order number of the frame encoded in past and the category number of the current frame.

6. The image encoding method as described in claim 4,

characterized in that said tentative frame number setting step has

- an encoding order recording step for recording an encoding order of a frame encoded in past as an encoding order number,

- a category number recording step for recording the category number of the frame encoded in past, and

- a tentative frame number determining step for determining the tentative frame number of the frame encoded in past, from the encoding order number of the frame encoded in past and the category number of the current frame.

7. The image encoding method as described in claim 5 or 6, characterized in that said tentative frame number determining step has

- a difference frame number assigning step for assigning a difference frame number in an order of larger encoding order number, and

- a tentative frame number calculating step for being equipped in advance with a table for assigning the tentative frame number with respect to a combination of the difference frame number and the category number of the current frame, and calculating the tentative frame number by referring to the table from the difference frame number and the current frame number.

8. The image encoding method as described in claim 5 or 6, characterized in that said tentative frame number determining step has

- a difference frame number assigning step for assigning a difference frame number in an order of larger encoding order number, and

- a tentative frame number calculating step for setting in advance a calculation formula for calculating the

tentative frame number with respect to a combination of the difference frame number and the category number of the current frame, and calculating the tentative frame number from the difference frame number and the current frame number by calculation.

9. An image decoding method for decoding image data formed by a plurality of frames, the image decoding method characterized by having

- a current category decoding step for decoding a category number of a current frame,

- a reference image specifying data decoding step for decoding a reference image specifying data which specifies a reference image data, for said decoded category number,

- a predicted image producing step for producing a predicted image from an image data specified by said reference image specifying data,

- a difference decoding step for decoding a difference between a decoded image of the current frame and the predicted image,

- a decoded image producing step for producing the decoded image of the current frame from said decoded difference data and said predicted image, and

- a decoded image storing step for storing said produced decoded image data of the current frame into a reference image memory for said decoded category number.

10. The image decoding method as described in claim 9, characterized in that

- said reference image specifying data is formed by a category number to which the reference image data to be read from said reference image memory by said predicted image producing step belongs and a frame number for specifying a frame belonging to a category specified by that number.

11. The image decoding method as described in claim 9, characterized in that said reference image specifying data decoding step has

- a tentative frame number setting step for setting a tentative frame number with respect to the image data of a frame belonging to an i-th category, among a plurality of image data stored in said reference image memory, and

- a tentative frame number decoding step for obtaining the tentative frame number which specifies an image data to be selected at said predicted image producing step, by decoding the reference image specifying data.

12. The image decoding method as described in claim 11, characterized in that said tentative frame number setting step has

- a decoding order recording step for recording a decoding order of a frame decoded in past as a decoding order number for each category, and

- a tentative frame number determining step for determining the tentative frame number of the frame decoded in past, from the decoding order number of the frame decoded in past and the category number of the current frame.

13. The image decoding method as described in claim 11, characterized in that said tentative frame number setting step has

- a decoding order recording step for recording a decoding order of a frame decoded in past as a decoding order number,

- a category number recording step for recording the category number of the frame decoded in past, and

- a tentative frame number determining step for determining the tentative frame number of the frame decoded

in past, from the decoding order number of the frame decoded in past and the category number of the current frame.

14. The image decoding method as described in claim 12 or 13, characterized in that said tentative frame number determining step has

a difference frame number assigning step for assigning a difference frame number in an order of larger decoding order number, and

a tentative frame number calculating step for being equipped in advance with a table for assigning the tentative frame number with respect to a combination of the difference frame number and the category number of the current frame, and calculating the tentative frame number by referring to the table from the difference frame number and the current frame number.

15. The image decoding method as described in claim 12 or 13, characterized in that said tentative frame number determining step has

a difference frame number assigning step for assigning a difference frame number in an order of larger decoding order number, and

a tentative frame number calculating step for setting in advance a calculation formula for calculating the tentative frame number with respect to a combination of the difference frame number and the category number of the current frame, and calculating the tentative frame number from the difference frame number and the current frame number by calculation.

16. An image encoding device for encoding image data formed by a plurality of frames, the image encoding device characterized by comprising

an image classifying unit for classifying each frame of an encoding target into N sets ($N \geq 2$) of categories,

a predicted image producing unit for producing a predicted image by selecting an image data from image data of a plurality of frames of an i -th ($1 \leq i \leq j$) category which are encoded in past, for a current frame which is classified as a j -th category,

a difference encoding unit for encoding a difference between the image data of the current frame and the predicted image,

a reference image specifying data encoding unit for encoding a reference image specifying data for the j -th category, which specifies the image data selected at said predicted image producing unit,

a current category encoding unit for encoding a category number of the current frame, and

a reference image memory for storing the image data of the current frame.

17. The image encoding device as described in claim 16, characterized by further having

a difference decoding unit for decoding an encoded data produced by said difference encoding unit, and

a decoded image producing unit for producing a decoded image from a decoded data produced by said difference decoding unit and said predicted image,

wherein said difference encoding unit encodes said difference by an irreversible encoding, and

said reference image memory stores a decoded image data of the current frame produced by said decoded image producing unit.

18. An image decoding device for decoding image data formed by a plurality of frames, the image decoding device characterized by comprising

a reference image memory for a plurality of frames which are classified into N sets ($N \geq 2$) of categories,

a current category decoding unit for decoding a category number of a current frame,

a reference image specifying data decoding unit for decoding a reference image specifying data which specifies a reference image data, for the category number obtained by said current category decoding unit,

a predicted image producing unit for producing a predicted image from an image data specified by said reference image specifying data,

a difference decoding unit for decoding a difference between a decoded image of the current frame and the predicted image,

a decoded image producing unit for producing the decoded image of the current frame from said decoded difference data and said predicted image, and

a decoded image storing unit for storing said produced decoded image data of the current frame into the reference image memory for the category number obtained by said current category decoding unit.

19. An image encoding method for encoding image data formed by a plurality of frames, the image encoding method characterized by having

an image classifying step for classifying each frame of an encoding target into N sets ($N \geq 2$) of categories,

a reference category setting step for setting a category that can be referred at a time of encoding a frame of a category to which a current frame belongs,

a reference image specifying data setting step for setting a reference image specifying data, for an image data of a frame stored in a reference image memory, which belongs to the category that can be referred that is set by said reference category setting step,

a predicted image producing step for producing a predicted image by selecting an image data from image data of a plurality of frames of the category that is set by said reference category setting step which are encoded in past,

a difference encoding step for encoding a difference between the image data of the current frame and the predicted image,

a reference image specifying data encoding step for encoding the reference image specifying data which specifies the image data selected at said predicted image producing step,

a current category encoding step for encoding a category number of the current frame, and

an image storing step for storing the image data of the current frame into the reference image memory.

20. The image encoding method as described in claim 19, characterized by further having

a difference decoding step for decoding an encoded data produced by said difference encoding step, and

a decoded image producing step for producing a decoded image from a decoded data produced by said difference decoding step and said predicted image,

wherein said difference encoding step encodes said difference by an irreversible encoding, and

said image storing step stores a decoded image data of the current frame produced by said decoded image producing step.

21. An image decoding method for decoding image data formed by a plurality of frames, the image decoding method characterized by executing

a current category decoding step for decoding a category number of a current frame,

a reference category setting step for setting a category that can be referred at a time of decoding a frame of a category to which the current frame belongs,

a reference image specifying data setting step for setting a reference image specifying data, for an image data of a frame stored in a reference image memory, which belongs to the category that can be referred that is set by said reference category setting step,

a reference image specifying data decoding step for decoding the reference image specifying data which specifies a reference image data,

a predicted image producing step for producing a predicted image from an image data specified by the reference image specifying data,

a difference decoding step for decoding a difference between a decoded image of the current frame and the predicted image,

a decoded image producing step for producing the decoded image from a difference data and the predicted image, and

a decoded image storing step for storing the decoded image of the current frame into the reference image memory for the category number obtained by said current category decoding step.

22. An image encoding device for encoding image data formed by a plurality of frames, the image encoding device characterized by having

an image classifying unit for classifying each frame of an encoding target into N sets ($N \geq 2$) of categories,

a reference category setting unit for setting a category that can be referred at a time of encoding a frame of a category to which a current frame belongs,

a reference image specifying data setting unit for setting a reference image specifying data, for an image

data of a frame stored in a reference image memory, which belongs to the category that can be referred that is set by said reference category setting unit,

a predicted image producing unit for producing a predicted image by selecting an image data from image data of a plurality of frames of the category that is set by said reference category setting unit which are encoded in past,

a difference encoding unit for encoding a difference between the image data of the current frame and the predicted image,

a reference image specifying data encoding unit for encoding the reference image specifying data which specifies the image data selected at said predicted image producing unit,

a current category encoding unit for encoding a category number of the current frame, and

a reference image memory for storing the image data of the current frame.

23. The image encoding device as described in claim 22, characterized by further having

a difference decoding unit for decoding an encoded data produced by said difference encoding unit, and

a decoded image producing unit for producing a decoded image from a decoded data produced by said difference decoding unit and said predicted image,

wherein said difference encoding unit encodes said difference by an irreversible encoding, and

said reference image memory stores a decoded image data of the current frame produced by said decoded image producing unit.

24. An image decoding device for decoding image data formed by a plurality of frames, the image decoding device

characterized by comprising

- a reference image memory for a plurality of frames which are classified into N sets ($N \geq 2$) of categories,

- a current category decoding unit for decoding a category number of a current frame,

- a reference category setting unit for setting a category that can be referred at a time of decoding a frame of a category to which the current frame belongs,

- a reference image specifying data setting unit for setting a reference image specifying data, for an image data of a frame stored in said reference image memory, which belongs to the category that can be referred that is set by said reference category setting unit,

- a reference image specifying data decoding unit for decoding the reference image specifying data which specifies a reference image data,

- a predicted image producing unit for producing a predicted image from an image data specified by the reference image specifying data,

- a difference decoding unit for decoding a difference between a decoded image of the current frame and the predicted image,

- a decoded image producing unit for producing the decoded image from a difference data and the predicted image, and

- a decoded image storing unit for storing the decoded image of the current frame into the reference image memory for the category number obtained by said current category decoding unit.

25. An image encoding method for encoding image data by producing low band image data and high band image data that are classified into N sets ($N \geq 2$) of categories from image data of a plurality of frames, the image encoding method characterized by having

a reference image specifying data setting step for setting a reference image specifying data, for an image data of a plurality of frames of a category that can be referred for a current frame which are stored in a reference image memory,

a predicted image producing step for producing a predicted image by selecting an image data from image data of a plurality of frames of the category that can be referred for the current frame which are stored in the reference image memory,

a difference encoding step for producing and encoding a high band image data from the image data of the current frame and the predicted image,

a reference image specifying data encoding step for encoding the reference image specifying data which specifies the image data selected at said predicted image producing step,

a current category encoding step for encoding a category number of the current frame, and

a decoding step for producing a low band image data from the high band image data and the predicted image and storing it into the reference image memory.

26. An image decoding method for decoding image data from high band image data and low band image data, the image decoding method characterized by having

a current category decoding step for decoding a category number of a current frame,

a reference image specifying data setting step for setting a reference image specifying data, for an image data of a frame stored in a reference image memory, which belongs to a category that can be referred for the current frame,

a reference image specifying data decoding step for decoding the reference image specifying data which

specifies a reference image data,

a predicted image producing step for producing a predicted image from a low band image data specified by the reference image specifying data,

a difference decoding step for decoding a high band image data,

a decoded image producing step for producing the decoded image from the high band image data and the predicted image, and

a decoded image storing step for storing the decoded image of the current frame into the reference image memory for the category number obtained by said current category decoding step.

27. An image encoding device for encoding image data by producing low band image data and high band image data that are classified into N sets ($N \geq 2$) of categories from image data of a plurality of frames, the image encoding device characterized by comprising

a reference image specifying data setting unit for setting a reference image specifying data, for an image data of frames of a category that can be referred for a current frame which are stored in a reference image memory,

a predicted image producing unit for producing a predicted image by selecting an image data from image data of a plurality of frames of the category that can be referred for the current frame which are stored in the reference image memory,

a difference encoding unit for producing and encoding a high band image data from the image data of the current frame and the predicted image,

a reference image specifying data encoding unit for encoding the reference image specifying data which specifies the image data selected at said predicted image producing unit,

a current category encoding unit for encoding a category number of the current frame, and

a decoding unit for producing a low band image data from the high band image data and the predicted image and storing it into the reference image memory.

28. An image decoding device for decoding image data from high band image data and low band image data, the image decoding device characterized by comprising

a current category decoding unit for decoding a category number of a current frame,

a reference image specifying data setting unit for setting a reference image specifying data, for an image data of a frame stored in a reference image memory, which belongs to a category that can be referred for the current frame,

a reference image specifying data decoding unit for decoding the reference image specifying data which specifies a reference image data,

a predicted image producing unit for producing a predicted image from a low band image data specified by the reference image specifying data,

a difference decoding unit for decoding a high band image data,

a decoded image producing unit for producing the decoded image from the high band image data and the predicted image, and

a decoded image storing unit for storing the decoded image of the current frame into the reference image memory for the category number obtained by said current category decoding unit.

29. An image encoding program for causing a computer to execute the image encoding method as described in any one of claims 1, 19 and 25.

30. An image decoding program for causing a computer to execute the image decoding method as described in any one of claims 9, 21 and 26.

31. A recording medium recording an image encoding program for causing a computer to execute the image encoding method as described in any one of claims 1, 19 and 25.

32. A recording medium recording an image decoding program for causing a computer to execute the image decoding method as described in any one of claims 9, 21 and 26.